WHAT IS THE MAXIMUM CREDIBLE EVENT FOR HAZARD DIVISION 1.6 EXPLOSIVE ARTICLES?

Presented by: Robert Griffith, B&W PANTEX
Pantex Plant, Amarillo, Texas
Tel: 806-477-6262, Fax 806-477-6845, Email rgriffit@pantex.com

ABSTRACT

Many important explosive safety functions such as hazard analysis, explosives hazard classification and facility siting are based on the anticipated maximum credible event. This paper focuses on the maximum credible event for Hazard Division 1.6 explosive articles. The research Mr. Griffith has recently completed at the Pantex Plant examines several explosives safety documents including DOD6055.09-STD, NAVSEA OP 5, DDESB Technical Paper 14, UN/SCETDG/33/INF.54, and DOE M 4401.1-A, and outlines the various Hazard Division (HD) 1.6 maximum credible events (MCE) described within those documents. In this paper Mr. Griffith discusses the wide range of maximum credible events identified in those documents with hazards ranging from mass fire, projection of fragments, blast from the detonation of a single item without fragmentation, to no significant hazard.

Unlike any other classifications of explosives, there is no empirical data to evaluate since there has never been a recorded accident involving HD 1.6 explosives. This paper does however compare the HD 1.6 test criteria of Series 7, Technical Bulletin 700-2 with the HD 1.6 MCEs descriptions identified in the various documents researched.

The purpose of this paper is to highlight the need to develop a singular, universally accepted Hazard Division 1.6 maximum credible event. The standardized application of a definitive HD 1.6 MCE is essential for many fundamental explosive safety functions such as hazard analysis, facility siting, and the determination of appropriate operating limits.

INTRODUCTION

For the past two decades various government agencies including the Department of Defense, Department of Transportation and the Department of Energy as well as international organizations such as the United Nations and NATO have all recognized the Hazard Division 1.6 hazard classification for explosive articles that are extremely insensitive.

In 1992 the DOD revised DOD 6055.09-STD and recognized the HD 1.6 hazard classification. In 1998 the Department of Defense Ammunition and Explosives Hazard Classification Procedures, TB 700-2 was revised to reflect the HD 1.6 hazard classification. Shortly thereafter, the Department of Energy also revised the Department of Energy Explosives Safety Manual, DOE Manual 440.1-1 to recognize this new hazard division.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUL 2010	**N/A**	**-**

4. TITLE AND SUBTITLE
What Is The Maximum Credible Event For Hazard Division 1.6 Explosive Articles?

5a. CONTRACT NUMBER
5b. GRANT NUMBER
5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

5d. PROJECT NUMBER
5e. TASK NUMBER
5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
B&W PANTEX Pantex Plant, Amarillo, Texas

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)
11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM002313. Department of Defense Explosives Safety Board Seminar (34th) held in Portland, Oregon on 13-15 July 2010, The original document contains color images.

14. ABSTRACT
Many important explosive safety functions such as hazard analysis, explosives hazard classification and facility siting are based on the anticipated maximum credible event. This paper focuses on the maximum credible event for Hazard Division 1.6 explosive articles. The research Mr. Griffith has recently completed at the Pantex Plant examines several explosives safety documents including DOD6055.09-STD, NAVSEA OP 5, DDESB Technical Paper 14, UN/SCETDG/33/INF.54, and DOE M 4401.1-A, and outlines the various Hazard Division (HD) 1.6 maximum credible events (MCE) described within those documents. In this paper Mr. Griffith discusses the wide range of maximum credible events identified in those documents with hazards ranging from mass fire, projection of fragments, blast from the detonation of a single item without fragmentation, to no significant hazard. Unlike any other classifications of explosives, there is no empirical data to evaluate since there has never been a recorded accident involving HD 1.6 explosives. This paper does however compare the HD 1.6 test criteria of Series 7, Technical Bulletin 700-2 with the HD 1.6 MCEs descriptions identified in the various documents researched. The purpose of this paper is to highlight the need to develop a singular, universally accepted Hazard Division 1.6 maximum credible event. The standardized application of a definitive HD 1.6 MCE is essential for many fundamental explosive safety functions such as hazard analysis, facility siting, and the determination of appropriate operating limits.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**SAR**	**24**	

Hazard Division 1.6 classification has typically been based on the Series 7 Tests identified in the United Nations ST/SG/AC10.1 Recommendations on the Transport of Dangerous Goods. The same Series 7 Tests has been adopted in Technical Bulletin 700-2, Department of Defense Ammunition and Explosives Hazard Classification Procedures. In addition to the Series 7 tests, the Department of Energy has additional qualification requirements for the testing of insensitive high explosive articles they have classified as HD 1.6 including the skid and spigot tests.

While these various agencies have all generally recognized the HD 1.6 hazard classification and accepted the same technical basis for it through the Series 7 tests, they have all reached very different conclusions regarding the MCE for HD 1.6 explosive articles as documented in the different publications cited in this paper.

THE MAXIMUM CREDIBLE EVENT

DOD 6055.09-STD defines the term maximum credible event as it relates to explosives. Appendix 1 Section AP1.151 states "In hazards evaluation, the MCE from a hypothesized accidental explosion, fire, or toxic chemical agent release (with explosives contribution) is the worst single event that is likely to occur from a given quantity and disposition of AE. The event must be realistic with a reasonable probability of occurrence considering the explosion propagation, burning rate characteristics, and physical protection given to the items involved. The MCE evaluated on this basis may then be used as a basis for effects calculations and casualty predictions."

By Department of Transportation definition, a Hazard Division 1.6 explosive article does not have a mass explosive hazard and demonstrates a negligible probability of accidental initiation or propagation. Webster dictionary defines negligible as "so insignificant as to be unworthy of consideration."

AFMAN 91-201, Section 12.96.2. states, "Perform hazard assessments to measure the potential for and consequences of mishaps resulting from the undesired release of energy or inhibiting the desired release of energy. Use these assessments to define the maximum credible event (MCE)."

What form of hazard assessment has been used in the past or should be used in the future to evaluate Hazard Division 1.6 explosives? In the opinion of this author, Test Series 7 provides a sound technical foundation for evaluating the potential for and consequences of a worst case accident scenario involving HD 1.6 explosives and should not only be used for HD 1.6 hazard classification but also be universally accepted as the standard in defining the HD 1.6 maximum credible event.

THE RISK FACTOR

In a recent review of the UN Test Series 7, (UN/SCETDG/33/INF.54), the Working Group for the United Nations Committee of Experts on the Transport of Dangerous Goods stated that the main difference between the classification of Hazard Division 1.1 to

1.4 and Hazard Division 1.6 is that in addition to consequences, risk is also taken into account in the classification of HD 1.6. This raises two questions:

- What is the risk associated with HD 1.6 explosives?
- What is the basis for determining the level of risk for HD 1.6 explosives?

In analyzing the probability of events, Technical Paper 14 states that Figure 3, Pe Matrix, was based on the evaluation of historical accident data compiled by all branches of the U.S. Armed Forces. This data was used not only to determine the risk by activity type, (i.e. disassembly, laboratory/test operations, storage, etc), but it was further categorized by Compatibility Group Elements. In the Pe Matrix, Storage Compatibility Group N is grouped into the same element group (Group III) as Storage Compatibility Groups D and E and assigned probabilities of events in several categories of activity. In an explanation as to how these Groups were chosen, Tech Memo E1-01000 simply states that Group III was considered the least sensitive.

Technical Paper 14 states in various places that the model is based on historical data of actual accident experiences compiled by the U.S. Army, Navy, Air Force, and Marine Corps. While there is a significant amount of historical data available concerning actual accidents involving SCGs D & E explosives, there is no data available for SCG N explosives since there has never been an accident involving HD 1.6 explosives that resulted in a violent response. As the historical data provided in Technical Paper 14 indicates, many SCG D & E explosives are sensitive to initiation by mechanical impact or sympathetic detonation. Consequences of such initiation includes mass explosion. These two forms of stimuli are addressed in the Series 7 HD 1.6N qualification tests. However, no violent reactions to these stimuli are allowed by any of the HD 1.6N test evaluation criteria beyond burning.

Based on the fact that there has never been a HD 1.6 event and the qualification testing criteria for HD 1.6, it truly deserves a category of it's own in the Pe Table of Technical Paper 14. The current grouping of HD 1.6N with HD 1.1D and HD 1.1E and assigning it the same probability for an event appears to be inappropriate as it lacks any technical basis.

Since there is no historical data indicating any accident involving HD 1.6 explosives and the Series 7 Tests described in TB 700-2 and United Nations ST/SG/AC for HD 1.6 do not allow for violent reactions from mechanical or thermal insults or sympathetic detonation, what is the probability of a HD 1.6 event? What really is the risk associated with a HD 1.6 event and what are the consequences of such an event?

THE CONSEQUENCES

Along with the risk associated with HD 1.6 explosive articles as quantified in Technical Paper 14, the consequences of a HD 1.6 event are also described in that document as well as several other sources from other agencies identified below.

- DOD 6055.09-STD, Section C.2.7 and the Air Force's AFMAN 91-201, Section 2.26. describe the consequences of a HD 1.6 event as being similar to a mass fire hazard, HD 1.3.

- A Department of Defense Explosives Safety Board (DDESB) memorandum to the Department of Transportation, states that HD 1.6 explosives pose the same safety risks as HD 1.2 explosives, a fragmentation/projection hazard.

- The inhabited building distance (IBD) for HD 1.6 explosives identified in DOD 6055.09-STD, Table C9.T.15 Note 1, DA Pam 385-64, Table 5-18, Note 4, and OP 5, Table 7-23, Note 4 is based on K40 for the largest single round of munitions. K40 is typically used for calculating IBD for HD 1.1 mass detonating explosives.

- The intraline distance (ILD) for HD 1.6 explosives also identified in DOD 6055.09-STD, Table C9.T.15 Note 1, DA Pam 385-64, Table 5-18, Note 4, and OP 5, Table 7-23, Note 4 is based on K18 for the largest single round of munitions. K18 is typically used for calculating ILD for HD 1.1 mass detonating explosives.

- The effects of HD 1.6 explosives are described as the blast equivalent of a HD 1.2 event in DOD 6055.09-STD, Section C2.3.1.1.

- Technical Paper 14, Table 3 describes the effects of a HD 1.6 event as the equivalent of one MK 82 general purpose bomb (blast effects only, no fragmentation.

- A HD 1.6 accident is described as non-mass explosion, fragment producing, with detonation of individual items in AFMAN 91-201, Table 10.1.

- UN/SCETDG/33.INF.54 states that a HD 1.6 accident is limited to the explosion of a single article.

- A DDESB Memorandum, Subject Updated Guidance for Substantial Dividing Walls, states that a HD 1.6 accident results in a detonation reaction.

- Technical Paper 14, Table 7 identifies a HD 1.6 accident as having the blast yield equivalency of 11% of one MK 82 general purpose bomb.

- HD 1.6 explosives are treated as HD 1.2 (projection hazard) munitions in underground storage per DOD 6055.09-STD, Section C9.7.2.1.6.

- DOD 6055.09-STD,Section C9.2.1.6 states that the net explosive weight for quantity-distance (NEWQD) is the total weight of EIDS in all HD 1.6 items. However, the weight of EIDS in a single HD 1.6 items shall also be considered, as specified in Table C9.T.15 for determining QD.

- DOE M 440.1-1A, Chapters VI and IX states that HD 1.6 facilities shall be sited as exposed sites not as potential explosion sites.

- DOE M 440.1-1A Chapter VI states that a HD 1.6 accidental detonation is not considered credible.

- TP 20-7 classifies items identified as HD 1.6 (per DOE M 440.1-1A) as HD 1.4.

- CAAP 891-1 (2) states that HD 1.4 and HD 1.6 explosives are handled without the need for safety distances.

- The Series 7 Tests described in TB 700-2 and United Nations ST/SG/AC consists of an article external fire test - UN Test 7(g), an article slow cookoff test - UN Test 7(h), an article bullet impact test – UN Test 7(j) and an article propagation test, also known as the stack test – UN Test -7(k). In addition to the four article tests, there are six qualification tests for the Extremely Insensitive Explosive Substance (EIDS) filler. In order to pass the article tests, the results of all tests must be negative. No violent reaction to any of the tests is acceptable for qualification as a HD 1.6 explosive article.

A matrix describing the consequences identified in the cited references is provided below.

Matrix of HD 1.6 Maximum Credible Events

MCE	DOD 6055.09	Technical Paper 14	UN/SCETDG/ 33/INF.54	AFMAN 91-201	DOE M 440. 1-1A	TP 20-7	TB 700-2	UN ST/SG/AC
Detonation of a Single Item	**X**	**X**	**X**	**X**				
Hazardous Fragments	**X**			**X**				
Mass Fire	**X**						**X**	**X**
Significant Blast Overpressure	**X**	**X**						
No Significant Hazard					**X**	[1] **X**	**X**	**X**

Note 1 – Items classed as HD 1.6 by DOE M 440.1-1A

THE NEED TO STANDARDIZE

Currently the consequences of a HD 1.6 event vary all the way from the detonation of a single item with fragmentation, to the detonation of a single item considering blast over pressure only with no fragmentation hazard, to the detonation of a single item with the blast overpressure only based on 11 percent of the NEW of the item that detonates, to mass fire with no fragmentation, to no significant hazard at all. This wide range of consequences for HD 1.6 explosives identified in the documents referenced in this report can be confusing when reliable information is needed for many explosives safety functions. Tasks such as performing hazards analyses, developing facility siting and associated site plans, establishing operating limits, and many other explosives safety activities depend on having accurate, reliable data, including the determination of the maximum credible event (MCE).

With the HD 1.6 events currently identified in the referenced documents, it is very hard to determine which event is applicable or which information source is reliable due to the lack of a technical basis for many of these determinations. With one set of qualification testing criteria, there's no reason why there can't be a single, uniformly accepted maximum credible event for HD 1.6 explosive articles. Consequence determinations should have a technical basis based on tests and/or accident data. Since there has never been an accident initiated event involving HD 1.6 explosives, the only technical basis available is testing.

The matrix below compares the various HD 1.6 events identified in the reference documents with the four Test Series 7 criteria for articles.

MCE	**Series 7 Test Criteria** **(Ref: TB 700-2, Section 6-5)**	**MCE Meets Series 7 Criteria as a HD 1.6 Article**
Detonation of a single item	None of the events occur during the 1.6 article Fire Test which would require the article to be assigned to HD 1.1 or 1.2 or 1.3 The reaction is no more severe than burning in the 1.6 Article Slow Cookoff Test No detonation or explosion response to the 1.6 Article Bullet Impact Test Note: Test criteria for the Article Propagation (Stack) test requires the intention initiation of one item in the center of the stack similar to the Series 6 Single Package Test.	No
Hazardous Fragments	None of the events occur during the 1.6 article Fire Test which would require the article to be assigned to HD 1.1 or 1.2 or 1.3 The reaction is no more severe than burning in the 1.6 Article Slow Cookoff Test	No

	No explosion response greater than burning or deflagration to the 1.6 Article Bullet Impact Test Note: Test criteria for the Article Propagation (Stack) test requires the intention initiation of one item in the center of the stack similar to the Series 6 Single Package Test.	No
Mass Fire	None of the events occur during the 1.6 article Fire Test which would require the article to be assigned to HD 1.1 or 1.2 or 1.3 The reaction is no more severe than burning in the 1.6 Article Slow Cookoff Test No explosion response greater than burning or deflagration to the 1.6 Article Bullet Impact Test	No Yes Yes
Significant Blast Overpressure	None of the events occur during the 1.6 article Fire Test which would require the article to be assigned to HD 1.1 or 1.2 or 1.3 The reaction is no more severe than burning in the 1.6 Article Slow Cookoff Test No detonation or explosion response to the 1.6 Article Bullet Impact Test No sympathetic detonation response in the 1.6 Article Propagation Test Note: Test criteria for the Article Propagation (Stack) test requires the intention initiation of one item in the center of the stack similar to the Series 6 Single Package Test.	No
No Significant Hazard	None of the events occur during the 1.6 article Fire Test which would require the article to be assigned to HD 1.1 or 1.2 or 1.3 The reaction is no more severe than burning in the 1.6 Article Slow Cookoff Test No explosion response greater than burning or deflagration to the 1.6 Article Bullet Impact Test No sympathetic detonation response in the 1.6 Article Propagation Test	Yes

CONCLUSION:

A comparison of the various consequences with the Test Series 7 criteria along with the fact that there has never been a HD 1.6 accident response points out the need to reconsider some of the HD 1.6 event consequences. A universally accepted maximum credible event for HD 1.6 articles based on Series 7 Test criteria should be adopted. A realistic event can then be used in everyday practical application for explosives safety functions such as hazard analyses, facility siting and establishing operating limits.

REFERENCES

ST/SG/AC.10/11/Rev 5, United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria,

TB 700-2, Department of Defense Ammunition and Explosives Hazard Classification Procedures
5 January 1998

DOD 6055.09-STD, DOD Ammunition and Explosives Standards, February 2008

NAVSEA OP 5 VOL 1, 7th Revision, Ammunition and Explosives Ashore Regulations for Handling, Storing, Production, Renovation and Shipping

DA Pam 385-64, Ammunition and Explosives Safety Standards, Dec 1999

AFMAN 91-201, Explosives Safety Standards, November 2008

DOE M 440.1-1A , DOE Explosives Safety Manual, January 2006

TP 20-7, "Nuclear Safety Criteria", January 2008

Title 49 Code of Federal Regulations, Department of Transportation, Hazardous Materials Regulations, 2010 Edition

Technical Paper 14, Approved Methods and Algorithms for DOD Risk-Based Explosives Siting Rev 4, July 2009

Pete Yutmeyer, "P_e Matrix", Tech Memo E1-01000, A-P-T Research Inc., Huntsville, AL May 2002

UN/SCETDG/33/INF.54, Explosives and Related Matters, Review of the UN Test Series 7

DDESB Memorandum, "Updated Guidance for Substantial Dividing Walls", Jan 2003

DDESB Memorandum, "Docket No. PHMSA-06-025885(HM-232F), November 2008

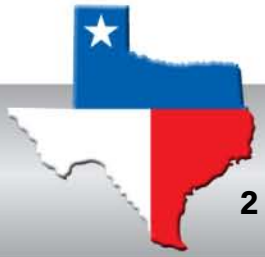
CAAP 891-2(2), "Safety Distances for Explosive Laden Aircraft"

What is the Maximum Credible Event for Hazard Division 1.6 Explosive Articles?

Presented by
Robert Griffith
34th DDESB Explosives Safety Seminar
Portland, Oregon July 15, 2010

OUTLINE

- Definition of Maximum Credible Event
- Definition of Hazard Division 1.6
- Wide range of HD 1.6 MCEs in various documents
- Test Series 7 Qualification Criteria
- Comparison of various sources
- Need for a consistent HD 1.6 MCE determination



Definition of Maximum Credible Event

The Maximum Credible Event is defined as:

"the worst single event that is likely to occur from a given quantity and disposition of AE. The event must be realistic with a reasonable probability of occurrence considering the explosion propagation, burning rate characteristics, and physical protection given the items involved."

DOD 6055.09-STD, Appendix 1

Hazard Divison 1.6 Definition

- **Explosive article, extremely insensitive (no mass explosion hazard)**

  DOD 6055.09-STD, Section C3.2.1

- **Consists of extremely insensitive articles which do not have a mass explosive hazard. This division is comprised of articles which contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.**

  49 CFR, 173.50.(b)(6)

  Webster's definition of negligible is

  "So insignificant as to be unworthy of consideration"

Hazard Division 1.6 MCEs - Various Sources

- HD 1.6 effects are similar to those produced by HD 1.3
  DOD 6055.09-STD, C2.7 , AFMAN 91-201, 2.26

- HD 1.6 explosives pose the same safety risks as HD 1.2
- DDDESB Memo to U.S. Department of Transportation, Nov 7, 2008

- HD 1.6 shall be treated as HD 1.2
  DOD 6055.09-STD, C9.7.2.1.6 (Underground Storage)
  DA Pam 385-64, I-3.c(1)

- The NEWQD is the total weight of EIDS in all HD 1.6 items. However, the weight of EIDS in a single HD 1.6 item shall also be considered, as specified in Table C9.T15, for determining QD.
  DOD6055.09-STD C9.2.1.6

Hazard Division 1.6 MCEs *(continued)*

- HD 1.6 Inhabited Building Distance = K40

  DOD 6055.09-STD, Table C9.T.15, Note 1 (for largest single round)
  OP 5, Table 7-23, Note 4; DA Pam 385-64, Table 5-18, Note 4

- HD 1.6 Intraline Distance = K18

  DOD 6055.09-STD, Table C9.T.15, Note 1 (for largest single round)
  OP 5, Table 7-23, Note 4; DA Pam 385-64, Table 5-18, Note 4

- HD 1.6 accident is the blast equivalent of a HD 1.2 event

  DOD6055.09-STD C2.3.1.1;

- HD 1.6 accident is the blast equivalent of one MK82 bomb

  Technical Paper 14, Table 3

Hazard Division 1.6 MCEs *(continued)*

- HD 1.6 accident results in a detonation reaction
  DDESB Memorandum, Subject: Updated Guidance for SDW

- HD 1.6 accident is limited to the explosion of a single article
  UN/SCETDG/33/INF.54

- HD 1.6 accident is the blast yield equivalent of 11% of one MK 82 GP Bomb (21.12 lbs NEW)
  Technical Paper 14, Table 7

- HD 1.6 accident is non-mass explosion, fragment producing. Detonation of individual items could occur. Provide protection from fragments.
  AFMAN 91-201, Table 10.1

Hazard Division 1.6 MCEs *(continued)*

- HD 1.6 facilities shall be sited as exposed sites (acceptor) not as potential explosion site (donor)
  DOE M 440.1-1A, Chapter VI

- HD 1.6 accidental detonation is not considered credible
  DOE M 440.1-1A, Chapter VI

- HD 1.6 articles (per DOE M 440.1-1A) are classified has HD 1.4D, no significant hazard
  TP 20-7, Section 5-3.2

- HD 1.4 and 1.6 explosives are handled without the need for safety distances.
  CAAP 891-1 (2)

Test Series 7 Qualification for HD 1.6

- **Qualification Testing for EIDS**

- **1.6 Article External Fire Test**
- **1.6 Article Slow Cook-Off Test**
- **1.6 Article Bullet Impact Test**
- **1.6 Article Stack Test**

Test Series 7 HD 1.6 Qualification

Matrix of Maximum Credible Events

Maximum Credible Event	DOD 6055.09	Tech Paper 14	UN/SCETDG/ 33/INF.54	AFMAN 91-201	DOE M 440.1-1	TP 20-7 * *Items classed as HD 1.6 per DOE M 440.1-1A	TB 700-2 (Series 7 Tests)	United Nations ST SG/AC Series 7 Tests
Detonation of a Single Item	X	X	X	X				
Hazardous Fragments	X			X				
Mass Fire	X						X	X
Significant Blast Overpressure	X	X						
No Significant Hazard					X	X	X	X

Matrix Comparing MCE with Test Criteria

MCE	Test Series 7 Criteria	MCE Meets Test Criteria
Detonation of a Single Item Hazardous Fragments Significant Blast Overpressure	Article Fire Test– No HD 1.1, 1.2 or 1.3 reaction No reaction more than burning to Slow Cookoff Test No detonation or explosion to Bullet Impact Test	No
Mass Fire	Article Fire – No HD 1.1, 1.2 or 1.3 reaction No reaction more than burning in the Slow Cookoff Test No response greater than burning or deflagration to Bullet Impact Test	No Yes Yes
No Significant Hazard	Article Fire Test– No HD 1.1, 1.2 or 1.3 reaction No reaction more than burning to Slow Cookoff Test No response greater than burning or deflagration to Bullet Impact Test	Yes

Need for Reevaluation of HD 1.6 MCE

- **Resolve the inconsistencies cited in documents from various sources**
- **Justify MCE determination with technical basis**
- **Standardization of HD 1.6 MCE for practical application in hazard analyses, facility siting and establishing operating limits**